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ADDITIONAL NOTICES.

(Printed by order of Council.)

1. *A Description of the Banda Islands.* By ALBERT S. BICKMORE, M.A.

On the 5th January, 1865, I sailed from Boston for Batavia, with the hope of being able to reach the Moluccas, and re-collect the shells figured in Rumphius' 'Rariteit Kamer.' On the 1st of May I arrived at Batavia, where I was honoured, by his Excellency the Governor-General of the Netherlands India, with an order to all the officers in the Dutch possessions in the East to receive me kindly and aid me in every possible manner. Thence I proceeded along the north coast of Java to Macassar, the capital of Celebes, and thence southward through Sapi Strait between Sumbawa and Flores, and eastward to Kupang, at the southern end of Timur. From Kupang I passed northward along the western shore of Timur, and crossing the Banda Sea arrived at Amboina, the capital of the Spice Islands, or Moluccas.

Here, thanks to the privileges secured to me by the order of the Governor-General, and to the kind assistance offered me by every official, in three months I accomplished all, and even more than I had dared to plan, and was prepared to visit some other part of the Archipelago, and turn my attention to some other branch of natural history.

During all the time I had been gathering, arranging, and packing my collections, Mr. Arriens, the governor of those islands, had frequently honoured me with a visit. He now called again, this time to give me a pleasant surprise. He had a fine steam yacht of 300 or 400 tons. It was necessary that he should go to Banda, and he took it for granted that I would accompany him; and when we returned, the yacht would take me through a large part of the Archipelago north of Amboina,—a royal programme.

On the 7th of September we steamed down the magnificent bay of Amboina for Banda. Our company consisted of the Governor, who was on a tour of inspection, myself, and an "officer of justice" and lieutenant, with a detachment of soldiers, who had in custody a native of Java, that was sentenced to be hung as soon as we should reach our destined port.

The worst of the rainy season along the south coast of Ceram was now over, and the evening was cool, clear, and delightful. Early the next morning Banda, or more properly the Bandas, were in full view. They are ten in number; the largest, Lontar, or Great Banda, is a crescent-shaped island, about six miles long and a mile-and-a-half wide in its broadest parts. Its eastern horn curves towards the north, and the other points to the west. In a prolongation of the former lie Pulo Pisang, "Banana Island," and Pulo Kapal, "Ship Island." The first is only about two-thirds of a mile long and half as wide, and the last is merely a high rock, resembling the poop of a ship, hence its name. Within the circle of which these islands form an arc, lie three other islands. The highest and most remarkable is the Gunong Api,* or "Burning Mountain," apparently attaining a very considerable elevation, because its sides rise so abruptly up from the sea. Between the Gunong Api

* This Gunong Api must not be confounded with another similar volcano, of the same name, north of Wetta, and still another near the western end of Sumbawa, at the northern entrance of Sapi Strait.

and the northern end of Lontar lies Banda Neira, about two miles long and less than a mile broad. North-east of the latter is a small rock called Pulo Krakka, or "Women's Island." The centre of the circle of which Lontar is an arc, falls in Sun Strait, a narrow passage separating Gunong Api from Banda Neira. The diameter of this circle is about six miles. Without this another concentric circle may be drawn, which will pass through Pulo Ai (Wai), "Water Island," on the west, and Rosengain on the south-west; and outside of this a third concentric circle, which will pass through Pulo Swangi, "Sorcery," or "Spirit Island" on the north-west, Pulo Run (Rung), "Chamber Island," on the west, and the reef of Rosengain on the south-west. The total area of the whole group is only 17.6 geographical square miles.

The first European who reached these beautiful and long-sought islands was d'Abreu, a Portuguese; but he cannot properly be called their discoverer, for the Arabs and Chinese, and probably the Hindus, had been trading here for years before his arrival, and De Barros informs us that "d'Abreu (while on his way from Malacca) touched at Gresik, in the eastern part of Java, to procure Javanese and Malay pilots, who had made this voyage." Barros further adds: * "every year there repair to Sutatam (Lontar) Javanese and Malays to load cloves, nutmegs, and mace, for this place being in the latitudes most easily navigated, and where ships are most safe, and as the cloves of the Moluccas are brought to it by vessels of the country, it is not necessary to go to the latter in search of them. In the *five* islands now named—Lontar, Rosengain, Ai, Run, and Neira—grow all the nutmegs consumed in every part of the world. A proof of the correctness of Barros' statements is seen in the names of the different islands mentioned above, for they are all of Malay or Javanese origin. The aboriginal population at that time is given at 15,000, which, if correct, would have made this group far more densely peopled than any other island or number of islands in the whole archipelago at the present day.

Our fast yacht rapidly brought us nearer over the quiet, glassy sea. This is Pulo Ai on our right. It is only from 300 to 400 feet high, and, as we see from the low cliffs on its shores, is mostly composed of coral rock. This is also said to be the case with the other islands outside of the first circle, and we notice that they are all comparatively low.

We now change our course to east, and steam up under the high, steep Gunong Api. On its N.N.W. side, about one-fourth of the distance from its summit down to the sea, there is a deep wide gulf, out of which rise thick, opaque clouds of white gas, that now, in the still clear air, are seen rolling grandly upward in one gigantic expanding column to the sky. On the top, also, thin clouds occasionally gather, and then slowly float away like cumuli, dissolving in the pure ether. These cloud masses are chiefly composed of steam and sulphurous acid gas, and, as they pour out, indicate what an active laboratory there is within the bowels of this volcano.

The western horn of crescent-shaped Lontar is before us. Its shore is composed of a series of nearly perpendicular crags, 200 or 300 feet high; but on the north side the luxurious vegetation of these tropical islands does not allow these rocks to remain naked, and from their horizontal crevices and upper edges hang down thick wide sheets of a bright green unfading verdure. The western entrance to the harbour, through which we are now passing, is between the abrupt magnificent coast of Lontar on the right, and the high, overhanging peak of Gunong Api on the left, and, as we advance, these separate and open to our view the steep lofty wall that forms Lontar's northern shore. This is completely covered with one dense matted mass of vegetation, out of which rise the erect columnar trunks of palms, from whose crests, as

* *Vide* "Barros" in Crawford's complete and accurate work, 'Dictionary of the Indian Islands.'

from sheaves, long feathery leaves hang over, and slowly and gracefully oscillate to and fro in the slight air which we can just perceive fanning our faces. Now Banda Neira is in full view. It is composed of hills, which gradually descend to the shore of this little bay. On the top of one near us is Fort Belgica, in form a regular pentagon. At the corners are bastions surmounted by small circular towers, so that the whole exactly resembles an old feudal castle. Its walls are white and almost dazzling in the bright sunlight, and beneath is a broad neatly clipped glacis, forming a beautiful, green, descending lawn.

Below this defence is Fort Nassau, which was built by the Dutch when they first arrived in 1609, only two years before the foundations of Belgica were laid, and both fortifications have existed, much as they are now, for more than two centuries and a half. To the right and left of this fort extends the chief village, Neira, with rows of pretty shade-trees on the bund, or front street bordering the bay. Its population is about 2000, and that of the whole group between 6000 and 9000.

In the roads were a number of praus from Ceram; odd-shaped vessels, high at the stern and low at the bow, and, instead of a single mast, a tall tripod, which can be hoisted or lowered at pleasure. They were all poorly built, and it seemed a wonder that such awkward boats could live any time in a rough sea. A number of Bugis traders were also at anchor near by. They are mostly hermaphrodite schooners, carrying a square-sail or foresail, a fore-topsail, and a fore-royal, and evidently designed like the praus to sail only before the wind. They visit the eastern end of Ceram and the western and south-western parts of New Guinea, the Arru group, and all the thousand other islands between Banda, Timur, and Australia. When the mail steamer that took me to Amboina touched here, a merchant of this place, who joined us, brought on board four large living specimens of the *Paradisaea apoda*, or Great Bird of Paradise, which he had purchased a short time before from one of these traders, and was taking with him to Europe.* They were all very sprightly and in superb condition, and their colours had a bright, living hue, incomparably richer than the most magnificent specimens I have ever seen in any museum.

At our main truck a small flag slowly unfolds, and displays to those on shore a red ball. This indicates that the Governor is on board, and soon a boat comes off to take us to the village; but as business is not very pressing, as is usually the case here in the East, we prefer to conform to the established custom in these hot lands, and quietly enjoy a siesta instead of obliging our good friends on shore to come out in full dress and parade in the scorching sunshine.

Our first excursion was to the western end of the opposite island, Lontar, —the Malay name of the Palmyra palm, *Borassus flabelliformis*, whose leaves were used to write upon over all the archipelago before the introduction of paper by the Arabs or Chinese; and in some places even at the present time. Lontar, as already noticed, has the form of a crescent. Its inner side is a steep wall, bordered at the base with a narrow band of low land.

On its outer side, from the crest of the wall many radiating ridges descend to the sea, its south-western shore is a series of little points separated by small bays. The whole island is merely one continuous forest of nutmeg and *canari*-trees. The nutmeg-tree, *Myristica moschata*, belongs to the order *Myristicaceæ*. A foot above the ground the trunk is from 6 to 10 inches in diameter. It branches somewhat like the laurel, and its topmost sprays are frequently 50 feet high. It is dioecious, that is, the pistils and the stamens are borne on different trees, and of course some trees never bear fruit. The fruit, or *drupe*, before it is fully ripe, in size and form very closely resembles a

* I afterwards learned that two of them were still living when he reached France.

peach that has not yet been tinged with red: but this exterior is only a thick fleshy rind (*epicarp*) which soon opens into two equal parts; and within is seen a spherical, black, polished nut, surrounded by a finely branching aril—the “mace”—of a bright vermillion. In this condition it is probably by far the most beautiful fruit in the whole vegetable kingdom. It is now picked by means of a small basket fastened to the end of a long bamboo. The outer part being removed, the mace is carefully taken off and dried on shallow bamboo baskets in the sun. During this drying process its bright colouring changes to a dull yellow. It is now ready to be packed in casks and sent to market.

The black, shining part seen between the ramifications of the vermillion mace is really a shell, and the nutmeg is within. As soon as the mace is removed, these black nuts are taken to a room and spread on shallow trays of open basket-work. A slow fire is then made beneath them, and here they remain for three months. By the end of this time, the nutmeg has shrunk so much that it will rattle in its black shell. The shells are now broken, and the nutmegs sorted and packed in large carefully-made casks of *jati*-wood, and a brand is placed on the head, giving the year the fruit was gathered and the name of the plantation or “park” where it grew.

From Neira a large cutter took us swiftly over the bay to Selam,—a small village containing the ruins of the old capital occupied by the Portuguese during the sixteenth and early part of the seventeenth centuries, while their rights remained undisputed by the Dutch. This western end of Lontar is about 400 feet high, and is composed of coral rock of very recent date. Walking eastward we next came to a conglomerate containing angular fragments of lava. This was succeeded on the shore of the bay by a fine-grained, compact lava, somewhat stratified, and this again by trachytic and basaltic lavas. Indeed nearly this whole island is composed of such eruptive rocks, and Lontar may be regarded as merely a part of one immense crater about 6 miles in diameter, if it were circular, though it may have been more nearly elliptical. Pulo Pisang and Pulo Kapal, already noticed as falling in this circle, are two other fragments of the old crater walls—all the rest have disappeared beneath the sea. Here then, is another, enormous crater, greater even than that seen among the Zeugger Mountains on the eastern end of Java, whose minor and major axes severally measure *three miles and a half* and *four miles and a half*, and whose floor of naked sand is well named by the Malays “the Sandy Sea.” Banda Neira represents the extinct craters rising in that Sandy Sea, and Gunong Api has a complete analogue in the still active Bromó. The enclosed bay, where vessels now anchor in 8 or 9 fathoms, is the bottom of this old crater, and, like that in the Zeugger Mountains, is composed of volcanic sand.

The radiating ridges on the outer side of Lontar represent the similar ridges on the sides of every volcano that is not building up its cone by frequent eruptions at its summit.

Lastly, the islands crossed by the second and third circles are so many cones on the flanks of this great volcano. True, those parts of some of them now above the sea are largely composed of coral rocks, like the west end of Lontar; but undoubtedly the polyps began to build their massive walls on the shores of islands of lava rock. They are doing this at the present moment. Every island in the group is now belted with a fringing reef, except at a few places where the shore is a perpendicular precipice, and the water of great depth. The western entrance through which we came to the roads is already quite closed up by a broad reef of living, growing coral.

A stroll through these beautiful groves, particularly at such a time, would be one of the richest pleasures a traveller could enjoy. All the nutmeg-trees were loaded down with fruit, which is chiefly gathered during this month, September, and again in June, though some is obtained from time to time throughout the year. It seemed surprising to me that the trees could be so loaded with fruit season after season; but the official reports show that, contrary

to what has been true of the clove, there has been but little variation in the annual yield of the nutmeg for the last thirty years.

An average crop for the last twenty years has been about 580,000 Amsterdam lbs. of nuts, and 137,000 lbs. of mace. The whole number of trees on Lontar, Neira, and Ai, the only three islands where they are cultivated, is in round numbers 450,000, of which only two-thirds bear fruit. As the Governor remarked to me while I was wondering at the abundance of fruit on every side, it is indeed strange that the income from all this produce does not equal the expenses of the Government in this residency. For this cause the Government proposes to give up the monopoly. Beneath these trees is spread a carpet of green grass, while high above them the gigantic canari-trees stretch out their gnarled arms and shield the valuable trees entrusted to their care from the strong winds which strive in vain to make them cast off their precious fruit before it is ripe. Such good service do the tall canaris render in this way that they are planted everywhere, and when the island is seen from a distance their tops quite hide the nutmeg-trees from view. The roots of this tree are remarkable. They spring off from the trunk above the ground in great vertical sheets, which are frequently 4 feet broad where they leave the tree. These wind back and forth for some distance before they disappear beneath the earth, so that the lower part of one of these old trees might well be fancied to be a huge bundle of enormous snakes struggling to free themselves from the Titanic hands that held them firmly for ever. As we leisurely passed along the crest of Lontar, with a thick foliage over our heads that effectually shut out the direct rays of the sun, we occasionally caught distant glimpses of the blue sea breaking into white, sparkling surf on the black rocks, far, far beneath us.

Soon we came to the "Look-out," known here, however, by the Malay name *Drang datang*, "the People Come;" for it is a peculiarity of that language, instead of naming a place like this *subjectively*, as we do, that is, from one's own action, to name it *objectively*, that is from the result of that action. This is placed on the edge of the interior wall, and is about 600 feet above the sea. From this point most of the *Bandas* can be distinctly seen in a single glance; and this view is undoubtedly one of the finest among all the isles of the sea. Before us was Banda Neira, with Neira, its pretty village, and left of this the dark, smoking volcano, and beyond both, on the right, Banana Island, where the lepers live in solitary banishment, and still further seaward Ship Rock, with the swell chafing its abrupt sides, while on our right in the distance were Pulo Ai and Pulo Run. All these rose out of the blue sea, which was only ruffled here and there by light breezes, or flecked by shadows of white fleecy clouds that slowly crossed the sky.

The next day we again went over to Lontar, and walked westward along the narrow band of low land between the base of the old crater-wall and the bay, visiting a number of the residences of the "Perkenniers," or "Park-keepers." Each of these consists of a rectangular area of about a quarter of an acre, enclosed by a high wall. The side next the sea is formed by the proprietor's house, and on the other three sides of the great open yard are rows of store-houses, and the houses of the natives who work on that plantation. Near the place at which we landed was a small area where all the mace is *white*, when the fruit is ripe, instead of red. From the west end of the island we followed most of the distance round its outer shore, and then crossed to our landing.

The Governor having finished his inspecting duties, now proposed that we try to reach the top of Gunong Api. There was only one man—a native—who had ever been to the top, and "knew the way;" though, to judge from a distance, one part of the mountain was just as dangerous as every other. He was engaged as our guide, and some ten others, whose duty it was to carry our lunch and a good supply of water in long bamboos. Early the next morning the coolies were ready. From the west end of the village we crossed the narrow "Strait of the Sun" to the foot of the mountain. Some coolies who had preceded us had cleared a

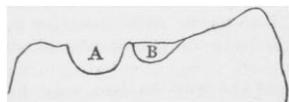
path up the steep declivity, but soon our only road was one of the many narrow tracks, where large masses of rocks and sand, which had loosened from some place high up the mountain, had shot down in a series of small land-slides, ploughing up the low shrubbery during its thundering descent. As long as we climbed among the shrubbery, although it was very difficult and tiring, it was not particularly dangerous until we came out on to the naked sides of the mountain; for this great elevation is not covered with vegetation more than two-thirds of the distance from its base to its summit. This lack of vegetation is caused by the frequent and wide land-slides, and by the great quantity of sulphur brought up to its top by sublimation, and washed down its sides by the heavy rains. Here we were obliged to crawl up on all fours among small, rough, black rocks of porous lava, and here all spread out until our party formed a horizontal line on the mountain side; so that when one man loosened the rocks, as every one was constantly doing, these might not come down and carry away some other man beneath him.

Our ascent now became slow and difficult; but we kept on, though sometimes the top of the mountain seemed as far off as the stars, until we were within about 300 feet of the summit. Here we came to a horizontal band of loose, angular fragments of lava from two to six inches in diameter. The mountain here rose at least at an angle of 35° , and to us, in either looking up or down, it seemed almost perpendicular. This band of stones was about 200 feet wide, and so loose that, when one was touched, frequently half-a-dozen would go rattling down the mountain. I had got about half-way across this dangerous place, when the stones on which my feet were placed *gave way!* This of course threw all my weight on my hands, when at once the rocks which I was holding with the clenched grasp of death also gave way, and I began to slide downward. The natives on either side of me now gave a loud shout, but not one dared to seize me, for fear that I should carry him down the mountain with me. Among these loose rocks a few ferns grew up and spread out their leaves to the sunlight. As I felt myself going down I chanced to roll toward my right side and notice one particularly, and quick as a flash of light the thought crossed my mind that my only hope was to seize *that fern*. This I did with my right hand, burying my elbow among the loose stones with the same motion; and that, thanks to a kind Providence, was sufficient to stop me, otherwise in less than a minute, probably in thirty or forty seconds, I should have been dashed to pieces on the rough rocks beneath me. The whole certainly occurred in a less space of time than it takes to read two lines on this page. I found myself safe, drew a long breath of relief, thanked God it was well with me, and, kicking away the loose stones with my heels, turned round, and kept on climbing. Above this band of loose stones the surface of the mountain was covered with a kind of crust formed chiefly of sulphur washed down by the rains. These rains had also formed many small grooves, and we made better progress here by crawling in these small gullies. At this moment the natives above us suddenly gave a loud cry, and I supposed of course that some one had lost his footing, and was going down to instant death. "Look out! Look out! Great rocks are coming!" and the next instant several small blocks and one great flake of lava two feet in diameter bounded by us with the speed of lightning. "Here is another!" It is coming straight for us, and it will take out one of our number to a certainty, I thought. I had stood up in the front of battle when shot and shell were flying and men were falling, but now to see the danger coming, and to feel that I was perfectly helpless, did, I must confess, make me quiver, and I crouched in the groove where I was climbing with the hope that it might bound over me; and that instant a fragment of lava about a foot square leaped up from the side of the mountain and flew directly over the head of a coolie a few feet on my right, clearing him by not more than five or six inches. I then supposed that the mountain was suffering another eruption, and that in a

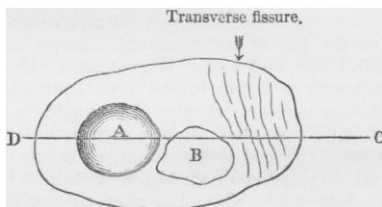
moment we should all be shaken down its almost vertical sides; but soon the rocks ceased coming down and we continued our ascent, and in a few moments stood on the rim of the crater.

The mystery in regard to the source of the falling rocks was now solved. One of our number had reached the summit before the rest of us, and with the aid of a native had been tumbling off rocks, for the sport of seeing them bound down the mountain, having stupidly forgotten that we all had to wind part-way round the mountain before we could get up on the edge of the summit, and not being able to lean over far enough to see that we were just beneath him.

The whole mountain is merely one great cone of small angular blocks of trachytic lava and black volcanic sand. The crater at its top is merely a conical cavity in this mass. The form of the summit is nearly elliptical, and is approximately given in the accompanying plan and section.



Vertical section along the line C D,
i.e., North-west and South-east.



Plan of the area on the summit of the Gunong Api
of Banda.

A, "the summit" crater. B, "old" crater.

The depth of the crater is about 80 feet. Its diameter we roughly estimated at from 100 to 150 yards. The area at the top is about 300 yards long, by 200 wide. This is composed of heaps of small lava-blocks, which are whitened on the exterior, and in many places quite encrusted with sulphur. Through these heaps of stones steam and sulphurous acid gas are continually rising, and we soon hurried round to the windward side to escape their suffocating fumes. In a number of these places we were glad to run, to prevent the shoes from being scorched on our feet by the hot rocks.

On the western side of the crater the rim is largely composed of sand, and in one place rises 120 feet higher than on the opposite eastern side. The top, therefore, partly opens out toward the east, and from some of the higher parts of Lontar one can see most of the area on the summit of this truncated cone. In this western part were many fissures, out of which rose sheets and jets of gas. When we had come to the highest point we looked over the north-west side down into the great crater, now active, one-fourth of the distance from the summit down to the sea. Dense volumes of steam and other gases were rolling up, and only now and then could we distinguish the edges of the deep, yawning abyss beneath us. Here we rested and lunched, enjoying meanwhile a magnificent view over the whole of the Banda group, when the suffocating gases were not blown into our faces. Again we continued round the northern side, and came down into an old crater, where we found a large rock with the word 'Etna,' the name of a Dutch warship, cut on one of its sides; and our Captain spent some time carving 'Telegraph,' the name of our yacht, beneath it. Great quantities of sulphur were seen here, more, the Governor said, than he had seen on any mountain in Java; for the great abundance of sulphur they yield is one of the chief characteristics of the volcanoes in this archipelago.

It was now time to descend. We called our guide, but he did not know where we ought to go, everything appeared so different when we looked down, from what it did when we looked upward. I chose a place where the vegetation was

nearest the top, and asked him if I could go down there, to which of course he answered Yes, as most people do when they do not know what to say, and must give some reply. I had brought up with me a long stick or kind of alpen-stock, curved at one end, and with this I reached down and broke places for my heels in the crust that covered the sand and small stones. For hundreds of feet beneath me the descent seemed perpendicular, but I slowly worked my way downward for more than a hundred feet, and had begun to congratulate myself on the good progress I was making—soon, I thought, I shall be down *there*, where I can lay hold of that bush and feel that the worst is past—when suddenly I was startled by a shout from my companions who were a short distance on my left. “Stop! Don’t go a step further, but climb up just as you went down.” I now looked round for the first time, and found to my surprise and alarm that I was on a tongue of land between two deep long holes or fissures, where great land-slides had recently occurred. I had kept my attention so fixed on the bush before me that I had never thought of looking to the right or left, generally a good rule in such perilous places.

To go on was simply impossible, so I turned round, climbed up again and passed round the head of one of these frightful holes. If at any time the crust had been weak and had broken beneath my heels, no earthly power could have saved me from instant death. As I broke place after place for my feet with the staff, I thought of Professor Tyndall’s dangerous ascent and descent of Monte Rosa.

At last I joined my companions, who had found the way we had come up; and, after some slips and sprains and considerable bruising, we all reached the bottom and were glad to be off the volcano, and reaching Banda Neira, feel ourselves on *terra firma* once more.

For a few days I could scarcely walk or use my arms; but that lameness soon passed away—not so with the impressions made on my mind by the perils I had so narrowly escaped, and even now, when suddenly aroused from sleep, for a moment the past becomes the present, and I am once more on the tongue of land with a deep gulf on either hand, or I am saving myself again by grasping *that fern*.

The first European who reached the summit, so far as I am aware, was Professor Reinwardt in 1821; the second was M. S. Müller in 1828, and from that time till the 13th of September, 1865, when we ascended it, only one party had attempted this difficult undertaking, and that party was from the steamer *Etna*, whose name we had found on a large rock in the old crater.

The height of this volcano we found to be 707·5 mètres, 2321 feet. Its spreading base occupies less space, 2 miles square. In size, therefore, it is insignificant compared to the gigantic mountains on Lombok, Java, and Sumatra; but when we consider the great amount of suffering, and the immense destruction of property that have been caused by its repeated eruptions, it becomes one of the most important volcanos in the archipelago.

From Valentyn and later writers we learn that eruptions have occurred in the following years:—1586, 1598, 1609, 1615, 1632, 1690, 1696, 1712, 1765, 1775, 1778, 1820, and 1824.

That of 1615 occurred in March, just as the Governor-General, Gerard Reyust, arrived from Java with a large fleet to complete the war of extermination that the Dutch had been waging with the aborigines for nearly twenty years. For some time previous to 1820, many people lived on the lower flanks of Gunong Api, and had succeeded in forming large groves, or, as the Dutch prefer to name them, “parks” of nutmeg-trees. On the 11th of June of that year, just before 12 o’clock, in an instant without the slightest warning, an eruption began which was so violent that all the people at once fled to the shore and crossed in boats to Banda Neira. Out of the summit rose perpendicularly up a great mass of ashes, sand, and stones, heated until they gave out light like living coals. The latter hailed down on every side, and as the

accounts say, "set fire to the woods and soon changed the whole mountain into one great cone of flame." This happened unfortunately during the western monsoon, and so great a quantity of sand and ashes were brought over to Banda Neira, that the branches of the nutmeg-trees were loaded down until they broke beneath its weight, and all the parks on the island were totally destroyed. Even the water became undrinkable from the light ashes that filled the air and settled in every crevice. This eruption continued incessantly for *thirteen* days, and did not wholly cease at the end of six weeks.

During this convulsion the mountain was apparently split through in a N.N.W. and S.S.E. direction. The large, active crater, which we saw beneath us on the north-west side of the mountain, from the spot where we lunched, was formed at that time, and another was reported higher up between the new crater and the older one on the top of the mountain. A stream of lava poured down the western side into a small bay and built up a tongue of land 180 feet long. This fluid rock heated the sea within a radius of more than half a mile, and nearer the shore eggs were cooked in it. This lava stream is the more remarkable, because it is a great characteristic of the volcanos throughout the archipelago, that, instead of pouring out fluid rock, they only eject hot stones, sand, and ashes, or mud—that is, water mingled with sand and ashes,—such materials as are thrown up in those volcanos where the eruptive force is known to have attained its maximum and to be becoming weaker and weaker.

On the 22nd of April, 1824, while Governor-General Van der Capellen was entering the roads an eruption commenced, just as had happened 209 years before, on the arrival of Governor-General Reynst. A great quantity of ashes again rose upward from its summit, accompanied by clouds of "black smoke," in which lightnings darted, while such a heavy thundering rolled forth that it completely drowned the salute from the forts on Neira, in celebration of the Governor's arrival. This was followed by a second eruption, succeeded by a rest of fourteen days, when the volcano again seemed to have regained its strength, and once more ashes and glowing stones were hurled into the air, and fell in showers on all sides.

But the people of Banda have suffered quite as much from earthquakes as from eruptions, though the latter are usually attended by slight shocks. Heavy earthquakes, without eruptions, have occurred in 1629, 1683, 1710, 1767, 1816, and 1852.

Almost the first objects that attract one's attention on landing at the village are the ruins of those houses that were destroyed by the last of these fearful phenomena. Many houses had their walls levelled to the ground, but others, that were built with especial care, suffered little injury. These walls are made of coral-rock or bricks. They are two or three feet thick, and covered with layers of plaster. At short distances along their outer side, sloping buttresses are placed against them, so that most of the houses in Banda look more like fortifications than private residences. The first warning that any one had of the coming destruction was that the water suddenly began to stream out of the enclosed bay, and this continued until the war brig *Haai*, which was at anchor in 8 or 9 fathoms touched the *bottom*. Then came in a great wave from the ocean that rose at least to a height of 25 or 30 feet over the low western part of the village, which is separated from Gunong Api by the narrow Sun Strait. Praus lying near this shore were swept up against Fort Nassau, which was so completely engulfed, that it was stated to me that one of these native boats was carried over the walls of the fort, and remained inside when the sea had receded to its usual level. The part of the village over which the flood swept contained many small houses, and nearly every one of them was carried away.

This rapid outpouring of the water from this enclosed bay, or old crater, was probably caused either by the elevation of the bottom at that spot, or else

by a sinking of the floor of the sea outside, so that this water was drained off into some depression that had suddenly been found. We have no reason to suppose that there was any great commotion in the sea outside, and certainly there was no high wave or bore, or it would also have risen on the shores of the neighbouring islands. There are three entrances or straits which lead from these roads out to the open sea. Two of these are wide, and one is narrow. When the whole top of the volcano, that is Neira, Gunong Api, Lontar, and the area they enclose, was raised for a moment, the water streamed out through these straits, causing very strong currents, but as the land again instantly sank to its former level, the water poured in, and the streams of the two wider straits meeting and uniting, rolled on towards the inner end of the narrow passage. Here they all met, and piling up spread out over the adjoining low village, causing great destruction of life. At the Resident's house, a few hundred yards east of Fort Nassau, the water only rose some ten or fifteen feet above high-water level, and farther east still less. The cause assigned above, therefore, though the principal one, may not have been sufficient in itself to have made the sea rise so high over the south-western part of Neira and the opposite part of Gunong Api, and I suspect that an additional cause was that the land there sank for a moment below its proper level.

Valentyn thus describes another less destructive earthquake wave:—"In the year 1629, there was a great earthquake, and half an hour afterward a flood, which was very great, and came in calm weather. The sea between Neira and Selan (on the western end of Lontar) rose up like a high mountain, and struck on the right side of Fort Nassau, where the water rose nine feet higher than in common spring-floods. Several houses near the sea were broken into pieces and washed away, and the ship *Brill* lying near by, was whirled round three times." In this case, the facts that the water did not pour out of the roads into the sea, and that the "flood" did not come until half an hour after the shock had occurred, indicated that this wave had its origin elsewhere, and there is no need of supposing, as in the case of 1852, that any part of the group was elevated or depressed. However, all these events are but as yesterday, when we look back into the past history of this ancient volcano, for if we can judge by analogy, taking the great crater this day existing among the Zeugger Mountains as our guide, we see in our mind's eye an immense volcanic mountain before us. From its high crater, during the lapse of time, poured out successive overflows of lava, which solidified into the trachyte of Lontar. Then came a period when stones and sand were thrown up, which has not wholly ceased at the present day. During one of its mighty throes, its western half disappeared beneath the sea, if the process of subsidence had gone on so far at that time.

Slowly it sinks, until it is at least 400 feet lower than at the present time, for we found a bank of coral rock on the western end of Lontar at that height. The outer islands are now wholly submerged. This period of subsidence is then followed by one of upheaval, but not till the slow-building coral-polyps have made great reefs, which now become white chalky cliffs, and after many years attain their present elevation above the sea. A tropical vegetation meanwhile by degrees spreads downwards, closely pursuing the retreating sea, and the islands are exactly what we see them to be at the present day.

In 1846, Mr. Jukes announced, as the result of his observations in the southern part of this archipelago, that the whole line of islands eastward from the Strait of Sunda, to and including Timur, had been elevated within a recent period. On the latter island my observations, I now find, are quite identical with his. From Kolff we learn that elevated reefs are found among the islands eastward from the northern end of Timur, and here they occur again in the Bandas. Eastward of this point, and south-east from Goram, are the Matabello Islands, which, according to Mr. Wallace, are only coral reefs raised 300 or 400 feet.

North-west from the Bandas we come to Amboina. The most recent coral rock which I observed on that island was about 500 feet above the present sea-level. At that elevation many valves of the gigantic *Tridacna gigas* were found considerably decomposed, but always in pairs, as if they had once been partially surrounded with soft coral rock, which, wasting away, had allowed the valves to fall apart. Governor Arriens, who had carefully studied these recent coral reefs, gave me the important fact that he had followed them upward to a height of 800 feet, but not higher, and that at that elevation they seemed to suddenly disappear. At Wahai, on the north coast of Ceram, I found many recent corals, about 50 feet above high-water level, and also at Kayéli Bay, on the north side of Burn, at an elevation of 100 feet. The natives here assured me that the same kind of "white stone," coral rocks, was found among the hills; and I have no doubt that it will be found in the mountainous parts of all the other Moluccas, as high up as Governor Arriens has already observed it at Amboina. A member of the Commission sent by the Dutch Government to examine the coasts of New Guinea, informed me that at the back of Dorey, on the north coast, at the mouth of Geelondk Bay, there are hills of very late formations, and that he found there a recent shell at a considerable elevation, 100 or 200 feet. From this point westward, as far at least as the northern end of Celebes, all the islands are probably rising.

Thus we find over all this wide area a repetition of the subsidence followed by an upheaval already noticed on Banda. Indeed, there is every indication that all the eastern part, if not the whole, of the archipelago is now rising, and thus we have before us the grand spectacle of a great continent forming itself at the present time.

2. *Letter to Major-General Sir Andrew Scott Waugh, on Routes between Upper Assam and Western China.* By F. A. GOODENOUGH, Esq.

(Communicated by Sir A. S. WAUGH.)

"MY DEAR SIR,

"Understanding from our mutual friend Mr. John Fergusson, of Calcutta, that you are taking an interest in the discovery of lines of communication between India and China, viâ Northern Burmah, I venture to trouble you with some little information which I have gathered during a visit to Upper Assam in 1866, and from various other sources; and I enclose a rough sketch-map,* which will show you how short the distance is from British territory, on the one side, to the most westerly point attained from the China sea-board, viz., by Captain Blakiston, R.A., on the other.

"When in Assam I went up the Dehing River to the Terap for the purpose of visiting the coal-field there. I found that the inhabitants of a Singphoo village at the mouth of the Terap were in constant intercourse with the Hookoong valley of Upper Burmah, the locale of the amber mines and petroleum springs of that country, which they reached through passes in the Patkoi range. When there, some men from Hookoong (Beesa of the maps?) were on the spot, being about to take across some cattle.

"Inquiring about the distance, we were told that a man without a load could reach *Hookoong* in seven days, but that cattle would not complete the march under thirteen. The cattle of Assam, and especially of that part of Assam, are, from the coarseness of the herbage they feed upon, and inferiority

* Deposited in the Map-Room of the Society.—[ED.]